

## Article

# Power conditioning – Protecting the present and future production of the semiconductor and electronics industry



**Semiconductors are all around us. They control the computers we use to conduct business, the phones and mobile devices we use to communicate, the cars and planes that get us from place to place, the machines that diagnose and treat illnesses, the military systems that protect us, and the electronic gadgets we use to listen to music, watch movies and play games. Simply put, without semiconductors, the technology that we count on every day would not be possible.**

In order for semiconductor facilities to produce highly technological devices, systems are put in place to ensure continuous improvement and output is reached. The cost of lost production, downtime, quality, and ultimately lost profit, can be extremely significant for semiconductor manufacturing fabrication plants (FABs) that are not adequately protected. Investing in the best power protection solution will future-proof your equipment from the devastating effects of a power quality event. ABB has now developed a semiconductor and electronics segment, designed to assist you in selecting the best power protection solution to suit your facility's specifications.

### Typical problems semiconductor facilities encounter and how to solve them

The semiconductor industry has some of the most demanding applications in motion control. A combination of extreme accuracy and precision makes for super critical power protection. Semiconductor segments can be divided into two sequential sub-processes commonly referred to as front-end and back-end production. The entire process, both front-end and back-end, is complex and requires sophisticated technology to protect the most sensitive stages. Typical problems facing semiconductor facilities are:

**Voltage sags:** Semiconductor processes are extremely sensitive and are dependent on a stable and well regulated electrical power supply to tools and equipment. The most common and costly power quality problem is voltage sags. The PCS100 Active Voltage Conditioner (AVC) is specifically designed to correct voltage sags. It does not contain energy storage, instead taking power from the remaining electrical grid. As a result, it has a very low cost of ownership due to having no batteries to maintain and very low electrical loss. It has a small footprint, making it suitable for effective use inside plants where floor area is limited.

The PCS100 Industrial UPS (UPS-I) is an ideal complement to the PCS100 AVC. The PCS100 UPS-I incorporates energy storage, often in the form of ultracapacitors. This provides the energy to ride through very deep voltage sags and short power outages, and makes the PCS100 UPS-I suitable for direct connection to many semiconductor tool loads.

**Current issues:** Many of the connected loads in semiconductor plants draw current from an electrical supply that is rich in harmonics, imbalance and poor power factor. Conventional capacitor-based power factor correction can cause switching transients on the supply and be overloaded by harmonic resonance. The PCS100 Reactive Power Conditioner (RPC) is an electronic power factor correction system that uses an insulated-gate bipolar transistor (IGBT) inverter to correct power factor, imbalance and low order harmonics (5th and 7th). It is an ideal solution in a semiconductor manufacturing environment where many sensitive loads are present.

**Limited space:** Space for power protection equipment is often very limited in semiconductor plants. The PCS100 Medium Voltage UPS (MV UPS) provides a high level of power protection at medium voltage levels and is an ideal application for photolithography, ion implantations and etching tools, wafer testing, die cutting and air handling.

### The statistics – outlook for the economy

A strong semiconductor industry is vital to the global economy. Semiconductors are a foundational technology in virtually all sectors. As the building blocks of technology, semiconductors will continue to enable the world's greatest breakthroughs. From aerospace and consumer electronics to energy and medicine, entire industries will be transformed. Semiconductors have revolutionized the way we work, communicate, travel, entertain, harness energy, and treat illness. Semiconductor Applications Forecasters (SAFs) estimates the compound annual growth rate (CAGR) will be 3.4 percent from 2013 to 2018, reaching US \$384 billion in 2018. Furthermore, World Semiconductor Trade Statistics (WSTS) predicts the global semiconductor market will be up 3.4 percent to US \$345 billion in 2015. For 2016, the market is forecasted to be US \$355 billion, up 3.1 percent. By end market, automotive and communications markets are expected to grow stronger than the total market, whereas consumer and computer are assumed to remain almost flat.

Regionally, Asia-Pacific will continue to be the fastest growing region for production of semiconductors and is expected to reach US \$209 billion in 2016, which is already a share of almost 60 percent of the total semiconductor market.

### Securing the future of semiconductors

**Power protection** systems have been at the forefront of some of the world's biggest semiconductor production companies. From substations through to sensitive tooling and machinery, power protection systems offer reliable and efficient solutions, eliminating voltage disturbances and improving productivity. This year, the world's largest provider of independent semiconductor manufacturing services in assembly and testing, ASE (Advanced Semiconductor Engineering) based in Taiwan, ordered nine PCS100 AVCs. From 2013 to 2015, ASE has ordered a total of 14 PCS100 AVCs, to protect the packaging and testing of silicon chips, a total power protection plan consisting of 20 MW.

To find out more about ABB's solutions for the semiconductor and electronics industry visit:

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